

XX.—*Critical Notes on the Polyzoa.* By the Rev. THOMAS HINCKS, B.A., F.R.S.

I PROPOSE in the present paper to discuss a number of miscellaneous points, structural and systematic, in the history of the Polyzoa, not according to any definite plan, but in such order as may be convenient.

1. Family Adeoneæ, Busk.

(“Report on the ‘Challenger’ Polyzoa,” pp. 177–189.)

Under the above name Busk, in his latest work \*, has constituted a family group, in which are included a number of remarkable forms belonging to the genus *Adeona*, Lamouroux (*Dictyopora* of MacGillivray), and a somewhat heterogeneous company, many of whose members were distributed amongst the genera *Lepralia* and *Eschara* of the older writers. The group is divided into two sections:—(i.) the true *Adeoneæ*, characterized (almost universally) by a fenestrate zoarium and a very curious flexible stem; and (ii.) forms agreeing generally with the above in zoœcial character, but destitute of the fenestrate structure and the stem. The old name *Adeona* is retained for the first, whilst that of *Adeonella* is assigned to the second.

The points which are noted by Busk as characteristic of the *whole family* are briefly these:—(i.) “the presence of three distinct forms of cell” (zoœcia, and oœcial and avicularian cells); (ii.) the absence of oœcia of the usual type, their function being discharged by specially modified zoœcia; (iii.) the presence of large avicularian cells; (iv.) a special pore (or a number of such pores) on the front of the cell-wall; and (v.) a peculiarity in the avicularian mandible, which is

\* I cannot refer to Mr. Busk’s work at the present time without expressing my deep sense of the services which he has rendered to all students of the Polyzoa, and of the loss which they have sustained by his death. Not only has he enriched the literature of the Class with a series of admirable works, embodying the results of much able investigation and a wide experience, but it is not too much to say that he has been mainly instrumental in preparing the ground for the present generation of workers by introducing definite principles and systematic order, and supplying a scheme of classification, which, though to a large extent artificial, has been an invaluable help to the student in the treatment of his material, and has largely facilitated and stimulated research.

It is a matter of sincere regret to me that the criticisms which I venture to offer on some of his later conclusions have been so long delayed, and that I lose in consequence the benefit of the candid consideration which he would have been sure to give them.

furnished with an "articular process" at each end of the base.

It may be added that (according to Busk) the special pore of the *Adeoneæ* is formed in "at least three distinct ways."

Without at present discussing the precise significance of these characters, it may be remarked that the differences in the pores are of very serious import, so serious indeed that these structures are by no means morphological equivalents throughout the series, and possibly have not the same function.

The *Adeoneæ* are furnished with pores of substantially the same structure and exhibiting the same mode of development; the differences are only met with amongst the *Adeonelle*; and there can, I think, be little doubt that they leave us no choice but to dismember this genus should it indeed be retained.

Coming now to a consideration of the diversities existing amongst the pores in this section of the *Adeonidæ*\*, as defined by Busk, we find that two very distinct types occur—(i.) the pores are perforations of the main wall of the zoecium, and open directly into its cavity; they are single or in companies, simple or stellate; or (ii.) they are openings in the elevated tubular peristome, placed immediately under the secondary orifice, and give access, not to the cavity of the cell but to the interior of the peristome at some distance above the primary orifice. The two structures just described have clearly a totally distinct morphological significance, and possibly have also a different function.

Of the species referred to *Adeonella* in the 'Challenger' Report a large proportion are furnished with peristomial openings, and cannot properly be associated in the same generic group with those which have true pores.

In a previous paper† I have described the peristomial opening as it occurs in *Adeonella fuegensis*, Busk, and pointed out the essential difference existing between it and the Micro-porellidan pore, which in my judgment is of the same general nature as that of the *Adeoneæ*. Waters has also noted the difference between these structures and correctly appreciated its importance‡. He proposes to retain the name *Adeonella* for such forms only as have a peristomial opening.

\* I follow MacGillivray in adopting this form of the family name in preference to that employed by Busk.

† "Contributions towards Gen. Hist. of Mar. Pol., XII. Polyzoa from India," Ann. & Mag. Nat. Hist. for May 1884.

‡ "On the Use of the Avicularian Mandible in the Determination of the Cheilostomatous Bryozoa," Journ. R. Micr. Soc. ser. ii. vol. v. (1885).

As yet, however, this section of Busk's *Adeonella* has not been studied with sufficient thoroughness to admit of an accurate definition. Amongst the species which Waters refers to it one at least is an alien, *A. polystomella*, Reuss (*Pallasii*, Heller), which is, as I have already pointed out \*, an undoubted *Schizoporella*. This species, which is furnished with a median sinus, is destitute of avicularian cells, and it is doubtful whether the cells lining the margin of the zoarium, which are somewhat larger than the other zoœcia, but exhibit no further peculiarity, have a claim to be accounted œcial, or, as I propose to term the cells modified for reproductive purposes, *gonœcia*. The so-called pore is a gap in the extension of the peristome above the primary orifice, which is bridged over above by a calcareous bar uniting the two lateral aviculariferous prominences, and completing the secondary orifice. A similar form of peristomial opening occurs also in *Gephyrophora polymorpha*, Busk, and in other species. It has no special connexion with the family of the Adeonidæ.

The figures in the 'Challenger' Report show that there are several forms amongst the so-called *Adeonellæ* in which the orifice is distinctly sinuated; and it is stated that the commonest way in which the pore is formed is "by the constriction off of the lower part of the orifice, which in such cases is more or less deeply emarginate or sinuated" †. In the account of *Adeonella regularis*, Busk, which is furnished with a "bridge" and with the equivalent of a peristomial opening, we are told that "a very minute suboral pore is occasionally formed by the cutting away of a portion of the labial fissure" ‡.

The account leaves us in doubt whether this is more than an accidental thing. If the pore is not an essential part of the structure, I should be inclined to refer *A. regularis* to *Schizoporella*. So far I have examined no species in which the formation of the pore could be traced to a constriction of the sinus.

Waters (*loc. cit.*) has drawn attention to the occurrence of an oral sinus in some of the *Adeonellæ*, and emphasizes the importance of this character; but amongst the species which he has gathered into his restricted genus *Adeonella*, two (*A. intricaria* and *A. pectinata*) are described as having the lower margin of the orifice straight and entire. The mere presence of a peristomial opening can hardly be made the basis of a

\* "The Polyzoa of the Adriatic," Ann. & Mag. Nat. Hist. for March 1886, p. 263, pl. x. fig. 7.

† 'Challenger' Report, 1884, p. 178.

‡ *Ibid.* p. 187.

genus. Further investigation of some of the 'Challenger' species will be needful before we can safely determine their systematic place.

An interesting question arises as to the relation between the families of the Adeonidæ and Microporellidæ.

Busk has placed them wide apart in the system; but the links between the true *Adeonæ* and the *Microporellæ* are (to say the least) far from unimportant, and if it should appear that, on the whole, there are grounds for referring them to distinct families, the affinities which connect them should be fully recognized in our classification. The shape of the orifice and the special suboral pore are important characters which they share in common. Busk, indeed, was of opinion that the pore of the *Adeonæ* "differs widely in nature from the lunate pore of *Microporella* &c." ('Report,' p. 178); but he has not stated the grounds of his opinion. Both of them are special openings into the cavity of the cell, and probably subservient to the same function. The mode of their development must be substantially the same. The pore of *Microporella* is in some cases lunate, in others round, in others again elongate; it is sometimes finbriated, sometimes simple. The lunate form is due to the presence of a small rounded flap, which projects over the opening and partially closes it. This appendage is probably protective, like the marginal teeth, but has no peculiar significance. I can find nothing in the structure or development of the Microporellidan pore which indicates a difference in "nature" between it and the pore of the *Adeonæ*. The two are homologous structures, with the same general characteristics.

If we examine the points indicated by Busk as characteristic of the family of the Adeonidæ, with a view to determining their precise significance, we shall find, I think, that the presence of oöcial cells, or rather of cells specially modified for the discharge of the reproductive function (gonöcia), is the only one that is in any sense distinctive. The avicularian cells are far from uncommon, and are met with in many genera. In such a form as *Schizoporella serratimargo*, mihi, they bear the closest resemblance to those of *Adeona*. A familiar example of them is found in the British *Schizotheca fissa*, Busk.

The special pore, as I have shown, is essentially identical with that of *Microporella*. The peculiarity in the avicularian mandible could hardly be accounted a character of primary importance, even if it were confined to this family; but Waters has shown (*loc. cit.*) that it occurs in several species beyond its limits, which are referable to distinct genera. The

only character left, therefore, as the *peculium* of the Adeonidæ is the coexistence (generally) in the colonies of three forms of cell, of which the reproductive seems to be without an *exact* parallel amongst the Chilostomata.

But it must be noted that cases commonly occur in which the cell carrying the oöcium exceeds in size the ordinary zoöcium and is furnished (like the reproductive cell of the Adeonidæ) with a differently shaped orifice. This condition is strongly marked in such a species as *Schizoporella obliqua*, MacGillivray (sp.), in which there is a striking dissimilarity between the operculum of the ordinary zoöcium and that of the reproductive cell.

In *Schizoporella acuminata*, Hincks, the orifice of the gonöcium is about twice as large as that of the zoöcium, and assumes a different form. In cases of this kind, before the growth of the marsupium has commenced, the cells destined to discharge the reproductive function are known at once by their peculiarities of structure. In some species of *Steganoporella* (*S. magnilabris* and *S. Neozelanica*) the structure of the gonöcial cell is materially modified, and there is no external marsupium.

We have here in a less degree the very specialization of the reproductive function which we find amongst the Adeonidæ. The development of a class of cells with a modified structure in which the generative products originate is by no means confined to a single family. The character is widely diffused and can hardly, even in its most distinctive form, be made the basis of a family group or warrant the separation of species which exhibit such an essential identity of zoöcial structure as the Microporellidæ and a large proportion of the Adeoneæ of Busk.

There is a strong case then for the union of the latter family with the Microporellidæ in a single group, on the ground that the essential characters of the zoöcium are the same in both, whilst the differences between them are of common occurrence amongst the most nearly related forms. On the other hand, the remarkable specialization of the reproductive function amongst some of the Adeonidæ, which is assigned in many of the species to groups of peculiarly-constituted cells (subcolonies), distinguished by their size, by the structure of the orifice, and by the enlarged system of pores for the more complete aeration (probably) of the generative products, and the entire suppression of the usual marsupial arrangement, are undoubtedly points of much interest, though not in my judgment of primary systematic importance.

In a large proportion of cases the clusters of reproductive

cells scattered over the surface of the zoarium are associated with a few of the gigantic avicularia, which are disposed around them as if for the purpose of defence. They constitute a striking and unique feature, and, perhaps, mark the climax of this sort of specialization amongst the Chilostomata.

The division then of the Adeonidæ which exhibits the zoœcial structure characteristic of the genus *Adeona* I should refer to the family Microporellidæ, in which two subsections may be distinguished:—(a) containing species which are destitute of gonœcia, but furnished with an external marsupium (type *Microporella*); (b) containing species which are destitute of oœcium, but possess (for the most part) gonœcial and avicularian cells (type *Adeona*).

This view is sustained by the high authority of Prof. Smitt. He places his *Escharipora mucronata*, which he ranks along with *Eschara lichenoides*, Busk (not M.-Edwards), and *Eschara distoma*, Busk, and *Porina subsulcata*, Smitt, which undoubtedly belong to *Adeonella*, Busk (restricted), in his family Eschariporidæ along with such forms as *Microporella ciliata* and *M. flabellum*, Busk. And in his account of *P. subsulcata* he says: "It is necessary very carefully here to distinguish the various forms, because in the neighbourhood of this species we have to place the interesting *Adeonæ*, and then to decide from which simpler form that curious growth is nearest to be derived." ['Floridan Bryozoa,' part 2, p. 29.] It is, perhaps, only fair to add that though he gives a precise account of the avicularian cells, Prof. Smitt's attention does not seem to have been specially directed to the gonœcia; but the fact remains that after a careful study of the zoœcial characters, he saw no reason for isolating *Adeona* from the Microporellidæ.

Waters has already\* referred the species of *Adeona* and *Adeonella*, Busk (part.), which he has recorded from the Australian Tertiaries, to the genus *Microporella*, thus fully recognizing the affinities for which I contend, but, at the same time, rejecting (as I suppose) the genus *Adeona*. Apart however from mere variations in the habit of growth and adaptive modifications of less essential elements of structure, there may be found, I believe, a sufficient basis for a generic group in the remarkable distinction between the zoœcium and the reproductive cells and the entire absence of the oœcium which are characteristic of the *Adeonæ* of Lamouroux and Busk.

\* "Chilostomatous Bryozoa from Muddy Creek, Victoria," Quart. Journ. Geol. Soc. for Aug. 1883, and "Chilostomatous Bryozoa from Aldinga and the River Murray Cliffs, South Australia," *ibid.* August 1885.

MacGillivray adopts the family Adeonidæ, as constituted by Busk, but adds nothing to the evidence in its behalf which I have just discussed\*. He proposes the generic name *Adeonellopsis* for the section of Busk's *Adeonella* characterized by the presence of true pores, and assigns the species with a peristomial opening to the *Adeonella* of Waters. The latter, however, as I have already remarked, has not been strictly defined, and as at present understood includes in all probability very dissimilar forms. Of the 'Challenger' species referred to it [Waters, *loc. cit.*] *A. polymorpha* and *A. atlantica* must be accounted doubtful. I should certainly hesitate to place them at all without the opportunity of examining specimens. In the case of the latter the description is incomplete. *A. platalea* seems to be distinctly related to the Schizoporellidæ; the primary orifice is represented as deeply sinuated. The large spoon-shaped avicularium is a character which it shares with *S. spongites*, Smitt. The peristomial opening is not a distinctive feature. *A. intricaria* has a peristomial opening and an orifice with a straight lower margin, gonœcia, and avicularian cells. It is one of the forms which apparently must be separated from the Microporellidæ. *A. pectinata* must be placed amongst the doubtful forms. We have no account, as it seems, of the primary zoœcial orifice; the "mouth," described as having "the lower lip" straight, appears to be the secondary orifice; nor is it easy to understand "the reniform" pore placed low down on the "oœcial cells." The zoœcial pore is described as "sublabial," and must be a peristomial opening. The remaining species assigned by Waters to his genus *Adeonella* is *Schizoporella polystomella*, Reuss (= *S. Pallasii*, Heller), of which I have already spoken. There is clearly room for much further investigation of the forms referred to the genus *Adeonella*, Busk, in the 'Challenger' Report. *A. distoma* seems to be the only true Microporellidan included in it, so far as we are able to judge.

A question remains: Is there any sufficient ground for dividing the genus *Adeona*? Busk has shown † that the flexible stem is really the only character to which much importance can be attached that separates this form from *Adeonella*. The mere habit of growth would not count for much even if it were constant; but from Kirchenpauer's figures ‡ it appears that there are two species furnished with

\* "Descriptions of new or little-known Polyzoa.—Part IX.," Trans. Royal Soc. Victoria, 1886.

† 'Challenger' Report, p. 183.

‡ "Ueber die Bryozoen-Gattung *Adeonia*," 1879, plate i. figs. 2, 3.

the flexible stem which have the simple habit of *Adeonella*. On the other hand, the stem is sometimes present and sometimes wanting in a fenestrate species, not yet described, but which Mr. Busk proposed to call *Adeona Gattyæ*. The zoöcial characters are alike in *Adeona* and *Adeonella* (restricted).

It must be borne in mind that there is no element of structure amongst the Polyzoa so liable to adaptive modifications as the so-called radical appendages. We meet with striking illustrations of this fact amongst the Cellulariidae. In one and the same species the mode of attachment and the apparatus for effecting it exhibit the most remarkable differences. In the genus *Microporella* we have both crustaceous and erect bilaminate forms \*. In the latter section *M. flabellaris*, Busk, and *M. marginata*, Krauss, are attached by means of a flexible stem or peduncle composed of many chitinous tubular strands; *M. hastigera*, Busk, a kindred species, affixes itself by an adherent stony base. The calcareo-chitinous peduncle of *Adeona*, with its numerous radical appendages, is a much more complex structure than the foregoing, in correlation with the large and massive foliaceous expansions of which the zoarium consists. It supplies great flexibility and great strength and secure anchorage. But there is a strict analogy between the two, and the greater complexity does not affect the systematic significance of the structure. Genetic affinity is most surely indicated by the essential characters of the individual zoöcium, and in these *Adeona* and *Adeonella* do not differ. That the mode of attachment would vary with local circumstances and the habit of colonial growth was to be expected, but the unity of the group is in no degree affected by the adaptive change in a mere structural detail. There is then, in my opinion, no warrant for dismembering the genus *Adeona*; the species composing it will range themselves naturally and conveniently under two heads: (1) with a flexible stem and (commonly) a fenestrate zoarium; (2) without a flexible stem.

For crustaceous forms, agreeing in essential character with *Adeona*, Busk has instituted the genus *Reptadeonella*, which is a return to a discredited principle of classification, and one which Mr. Busk himself has abandoned in other cases. The name is specially objectionable as it commemorates a discarded

\* Busk, indeed, has instituted a genus for the latter (*Flustramorpha*); but the only distinctive character relied upon is the erect, bilaminate growth, which is absolutely immaterial. The chitinous stem and marginal tubes, which occur in *M. flabellaris* and *M. marginata*, it is admitted, have no generic significance, as "a similar condition obtains in species belonging to widely distinct genera" ('Challenger' Report, p. 135). It is very desirable, in the interest of a natural system, that such spurious genera should be weeded out.



doctrine, and emphasizes a point which has lost the systematic value it once possessed.

The only permanently crustaceous *Adeona* with which I am acquainted is the British species *A. violacea*. It shows unmistakably its affinity to *Microporella*, but is furnished with gonœcia and is destitute of the œccium. Avicularian cells are wanting, and the reproductive cells exhibit a somewhat lower degree of specialization than we meet with amongst the fenestrate and branching forms. They are scattered over the colony singly or in pairs (occasionally in larger number), are about twice as large as the zoœcia, slightly convex, and furnished with a narrow, transversely elongate orifice. So far as I have observed, however, there is little or no increase in the number of pores. Rarely two are met with instead of one, as in the zoœcia; but more generally there seems to be no increase of number, though the size of the pore is much greater. In the remarkable variety, however, which I have described and figured from the Channel Islands\* there are two pores in the zoœcia, and in the reproductive cells three or (commonly) four of considerable size †.

## 2. Family Membraniporidae.

### *Membranipora radificera*, Hincks.

In this curious species the structure conforms to the Membraniporidan type, but the mode in which the zoarium is attached bears a general resemblance to that which prevails amongst the Cellulariidae and Bicellariidae. A large number of tubular fibres is emitted from the inferior surface of each cell, so that the base of the zoarium is completely covered and concealed by the multitude of these root-like appendages, which penetrate into the ooze over which the polyzoon spreads, and attaching themselves to fragments of shell, stone, &c., hold it to its place. The adaptive modification is extremely interesting, but, like the flexible stem of *Adeona*, it has no special systematic value. We already know of one or two similar cases, and probably many more exist ‡. But another peculiarity (which is shared by the two species mentioned in the footnote) has been observed in *M. radificera* §. Its cells are partially disjunct, each of them is connected with the

\* Hist. Brit. Mar. Polyzoa, p. 216, pl. xxx. fig. 3.

† The differences between the var. and the normal *A. violacea* are so important that I believe it should rank as a species.

‡ I have described a similar structure in *Cribritina ferox*, MacG., and *Schizoporella argentea*, Hincks ("Contributions Gen. Hist. Marine Polyzoa," 'Annals' for July 1881 and March 1885.

§ "Contributions" &c., 'Annals' for July 1881.

neighbouring cells by six short processes or extensions of its wall, and these connecting bands, though not absolutely isolated from one another, are separated by a deep depression. So that we have a first step towards the retiform condition which is characteristic of such a form as *Diachoris*, Busk. On the strength of this structural peculiarity MacGillivray, in a recent part of his important work on the *Polyzoa* of Victoria, transfers this species to the genus *Beania* (which he identifies with *Diachoris*). In support of this view he points out that its avicularium is also transitional and marks an advance towards the capitate form which distinguishes the Bicellularian family. But *M. radificera*, whatever its transitional tendencies, is still a characteristic *Membranipora*. If it shows us a possible road from the one type of structure to the other, it has not itself joined the Bicellularian camp. Its cells are still united in a solid zoarium; its avicularium, though suggestive of change, has not reached the articulate goal, but remains fast soldered to its place and as incapable of movement as the most rudimentary appendage. It is not, I respectfully submit, permissible to sever it from the tribe to which its actual characteristics ally it, and transfer it to one towards which at most it has only a few structural leanings. Its partially disjunct cells and its avicularium, simulating the bird's-head form, are interesting as genealogical hints, but they are nothing more.

*Diachoris* (or *Beania*) is a true Bicellularian, with the chitino-membranous, boat-shaped cell of a *Bugula*, and the highly organized capitate and articulated avicularium so characteristic of that family. The reticulate structure of its zoarium is after all its least significant character; its place is determined by the essential structure of its zoecium, and, so far as this is concerned, it has little in common with the present species.

### 3. Family *Membraniporidae* (*continued*).

#### *Notes on the Genera.*

There is no more natural group amongst the *Polyzoa* than the *Membraniporae*, in which the primitive membranous covering of the cell endures, either wholly or in great part, as a permanent character. It embraces an immense number of species, and, as a matter of convenience, it would be desirable to break it up into subgroups, if any natural basis could be found for them. But important modifications of the typical characters are rare, and of the subdivisions that have been proposed a considerable proportion are purely artificial. In his

'Challenger' Report Busk includes four genera in the Membraniporidan family. Of these *Amphiblestrum* and *Bifustra* can hardly be regarded as anything but arbitrary groups; *Foveolaria* seems to have a claim to rank as a distinct genus. The section of the genus *Membranipora* of which *M. pilosa* is the type is classed as a family (Electrinidæ), containing a single genus, *Electra*, Lamouroux. This is an important change, and seems to be justified by the very striking peculiarities of the type. It may perhaps be a question whether the new 'Challenger' species *Electra cylindracea* is entitled to a place in the genus. The absence of an oecium seems to be characteristic of the other species referred to it.

MacGillivray has instituted the genus *Thairopora* for Membraniporidan forms in which the orifice is surrounded by a border and is closed by an operculum which works on a distinct hinge. There can be no doubt that this is rightly accounted an important structural change, and a good foundation for a generic group. I am unable, however, to agree with Mr. MacGillivray when he refers *Micropora Jervoisii*, Hincks, to his new genus\*. It has the front wall completely calcified and shows the other characters which distinguish the genus *Micropora* †.

#### 4. Family **Microporidae**, Smitt (part.).

*Membraniporidae*, Busk, B. M. Cat. (part.).

*Microporidae*, 'Challenger' Report (part.); Hincks, Brit. Mar. Pol. (part.).

In this family the calcification of the front wall is complete and the operculum rests upon a stony framework, which forms a border round it. It shares the depressed area and raised margins with *Membranipora*. One or two very different types of structure have been included in this group. Smitt referred to it both *Micropora* and *Steganoporella*, and I at one time took the same view. But I am now convinced that the forms which are furnished with what Dr. J. Jullien has termed the "double ectocyst" must be separated from *Micropora*, and are entitled to stand as a distinct family group. Dr. Jullien's contention ‡ that this peculiarity is of such significance as to warrant the distribution of the Chilostomata into two great tribes—those which possess it and those which do not—I am by no means prepared to admit. But there can be no doubt that it has a high morphological interest as a very distinct

\* "New or little-known Polyzoa.—Part XI," Trans. Roy. Soc. Victoria, 1886.

† "Contributions" &c., 'Annals' for February 1882.

‡ "Note sur une nouvelle division des Bryozoaires Cheilostomiens," Bull. de la Soc. Zool. de France, t. vi. (1881).

form of structure, and should be recognized as such in our system.

Busk (in the 'Challenger' Report) has included in the present family *Micropora*, *Steganoporella*, and a genus *Vincularia*, of which a cylindrical habit of growth is an essential character, and which in other respects is represented as being somewhat intermediate between *Micropora* and *Steganoporella*. The peculiar habit of growth (as Mr. Busk has elsewhere virtually admitted) is of no account whatever as an indication of affinity; and it would probably be better that such a name as *Vincularia*, which inevitably suggests cylindrical form, and little but this, should disappear from our nomenclature. *Vincularia gothica* of the 'Report' is furnished with the "double ectocyst," and will probably find a place in the same family as *Steganoporella* and its allies.

In the family of the Microporidæ such forms only must be included as agree in general structure with the well-known and widely distributed *Micropora coriacea*, Esper.

*Fam. char.*—*Zoëcia* with raised margins; *front wall* depressed, wholly calcified; *orifice* enclosed by a calcareous border, operculum with a distinct hinge.

The species of *Micropora* are invested by a membranous epitheca, which seems to be composed of comparatively stout and durable material, and is more persistent than is usual amongst the Polyzoa. A characteristic feature is the foramen on each side of the front wall a little below the orifice.

Amongst the forms which are furnished with the "double ectocyst" (some of which have hitherto ranked amongst the Microporidæ) are the species comprised in the genus *Steganoporella*, Smitt, *Membranipora antiqua*, Busk, and one or two kindred species described by Jullien, *Vincularia abyssicola*, Smitt, *Caleschara denticulata*, MacG., and *Diplopora cincta*, Hutton. In all these forms the front wall of the cell is simply membranous; it carries the oral opening and the operculum. At a greater or less distance below this membranous covering a calcareous lamina is interposed, which divides the cavity of the cell into two compartments, an upper and an under; the lower or aboral chamber contains the polypide, the use of the upper has not been determined. At the upper end of the calcareous lamina there is a large opening (*opesia* of Jullien) by means of which the two chambers are brought into communication and through which the polypide finds access to the orifice of the cell. The *opesia* is always of much larger size than the orifice and variable in shape.

The species characterized by the structure just described may rank as a single family, to which it is probably right that the name *Steganoporellidæ* should be assigned, Smitt

having founded his genus *Steganoporella* on the dithalamic condition of the zoœcium\*.

It would be pleasant to associate Dr. Jullien with this group, which he has so ably investigated, by adopting his name *Onychocellidæ*; but the scope of this family is much more restricted than that of the division which I propose, and further it is mainly based on a character (the structure of the avicularia) to which I find myself unable to attach the significance which he does.

### 5. Family *Steganoporellidæ*.

*Fam. char.*—*Zoœcia* closed by a membranous wall which carries the orifice and operculum, divided by a horizontal calcareous lamina, with a large variously-shaped opening (opesia) at the upper end, into two compartments, in the lower of which the polypide is lodged.

In the family thus constituted two principal groups are distinguishable. In one the aboral chamber is simple and undivided; in the other the inferior portion of it is shut off by a diaphragm from the upper, with which it communicates by means of a tubular passage; and in this lowest room of the somewhat complex structure the polypide is lodged. Of the first group we have a typical member in *Membranipora antiqua*, Busk (*Onychocella antiqua*, Jullien), whilst the second is well represented by *Membranipora magnilabris*, Busk (*Steganoporella magnilabris*, Smitt).

In the second division, however, it will be necessary to create two genera, for there are important structural differences between such species as *S. magnilabris* and *S. Neozelanica*, Busk, and *S. Rozieri*, Audouin (sp.), which have hitherto been included in the same generic group.

In *S. magnilabris* † the whole of the upper half of the cell forms in fact one large cavity, part of it above and part below the opesia, which is closed in by the very large operculum and the membranous front wall connected with it.

The tubular orifice of the polypide-cell opens out within the infra-laminar compartment, and a broad, shield-like denticle rises in front of it. But in *S. Rozieri*, Audouin (sp.), and allied species this denticular process is continued upwards, and unites with the margin of the cell, thus forming an orifice with a thickened rim, arched above and produced below. The upper half of this orifice (which is a kind of second opening to the polypide-cell) is closed by the operculum; the lower half remains open, but is overspread by the membranous front wall. By the structural modification just

\* 'Floridan Bryozoa,' part 2, page 15.

† 'British Museum Catalogue' (Busk), pl. lxx. fig. 4.

described the opesia is to a considerable extent concealed when the front wall is removed, and is represented by a large foramen on each side of the calcareous plate, supporting the orifice; whereas in *S. magnilabris* both opesia and the cavity of the cell below it lie open\*.

These differences in the cell are connected with important differences in the oöcial arrangements. In *S. magnilabris* there is no external ovicell, but its place is probably filled by a large internal chamber. The section to which *S. Rozieri* belongs is remarkable for the size of its bilobate oöcia, closed in front by a movable lid. For the section of the Steganoporellidæ represented by *Membr. antiqua*, Busk, Dr. Julien's name *Smittipora* may be adopted, but with a wider application than he has given to it. The differences between this genus and his *Onychocella* are, in my judgment, of slight importance, and the two groups, which agree in all essential characters, may be united under one name.

For the *magnilabris* section, Smitt's *Steganoporella* will be the proper designation. For the *Rozieri* division I propose the name *Thalamoporella*. The development of the cell in this genus can be well traced at the growing extremities of the branches in an erect and cylindrical form of *T. Rozieri*, form *gothica*, which I have received from California. In the earliest stage the zoöcium is a simple oblong box of considerable depth, closed in above by a delicate and transparent membrane. There is no sign whatever of the oral valve, nor any trace of the internal lamina. In a more advanced stage an arch of rather deeper horn-colour than the surrounding membrane makes its appearance at the top of the front wall; this gradually becomes more pronounced, and at last the lower margin, completing the oral semicircle, is faintly outlined below it. In adult cells the margin round the orifice becomes thicker, and is slightly produced at the articular angles.

The operculum resembles in structure that of the Membraniporidan genus *Thairopora*, MacG. In the younger zoöcia there is no trace of any internal structure; the growth of the lamina commences later on at the lower extremity of the cell.

Besides the forms already mentioned, the *Caleschara* of MacGillivray † belongs to the Steganoporellidæ. Avicularia seem to be wanting, and it is furnished with oöcia of the ordinary type. It is nearly allied to *Smittipora*, if not a member of that genus.

Another species which must be referred to this family is the

\* I hope to give figures illustrating the structural differences in a future paper.

† 'Zoology of Victoria,' dec. v. p. 45.

*Diplopora cincta*, Hutton, but its precise place I am unable to discuss at present.

The following table shows the arrangement of the Steganoporellidæ which I propose:—

Family **Steganoporellidæ.**

Genus **SMITTIPORA**, Jullien.

*Zoæcia* with the lower compartment (situated beneath the calcareous lamina) undivided.

Type: *S. abyssicola*, Smitt.

Genus **STEGANOPORELLA**, Smitt (part.).

*Zoæcia* with the aboral compartment divided into two chambers by a diaphragm, the lower of which is connected by a tubular passage with the upper and contains the polypide; the whole of the upper half of the cell forming a large cavity, closed in by the operculum and membranous front wall. Operculum very large. External oæcia wanting; represented by an internal chamber.

Type: *S. magnilabris*, Busk.

Genus **THALAMOPORELLA**, n. gen.

*Zoæcia* with the lower compartment divided; from the centre of the anterior extremity of the lamina a narrow calcareous wall is carried up to a level with the margin of the cell, to which it is united, forming an orifice, which is partially closed by the operculum; on each side of it a large foramen. Operculum small, semicircular. *Oæcia* external, bilobate.

Type: *T. Rozieri*, Audouin.

MISCELLANEOUS.

*On the Class Podostomata, a Group embracing the Merostomata and Trilobites.* By A. S. PACKARD.

In a paper read in November 1885 before the National Academy of Sciences we have endeavoured, by giving the history of the Xiphosura, Pœcilopoda, and Gigantostroaca, to show that while the name Xiphosura should be retained for the suborder of which *Limulus* is the type, the names Pœcilopoda and Gigantostroaca have been applied in such different senses that they cannot well be retained for the Merostomata and Trilobita taken together in the sense we advocate. We have therefore proposed the term Podostomata for this class of Arthropoda. It is derived from ποῦς, ποδὸς, foot, and στόμα, mouth, in allusion to the foot-like or ambulatory